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THURSTON'S GROUP FACTOR THEORY

OR

THEORY OF PRIMARY MENTAL ABILITIES

• Core concepts

- Primary Mental abilities - Thurstone identifies 7 distinct mental abilities. - Verbal comprehension, Numerical abilities, Spatial relations, Perceptual speed, Word fluency, Memory & Inductive reasoning. He argues that these are independent - meaning proficiency in one does not necessarily predict success in another & absolute - implying they cannot be broken down into smaller, simpler parts.
- Redefining intelligence - Unlike Spearman's theory which relies on a general 'g' factor, Thurstone suggests that intelligence operates through group factors. These factors are not common to all intellectual tasks but are specific to the activities that comprise a parti-

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cular group or category.

- Practical assessment - Intelligence is measured by observing how a child performs across different mental activities. If an individual displays these 7 abilities, they are considered intelligent, shifting the focus from general capacity to specific functional mental operations.

- The seven primary mental abilities

- Verbal comprehension - The ability to understand & explain verbal information effectively.
- Numerical ability - The capacity to perform quick & accurate mathematical calculations.
- Word fluency - The skill of expressing thoughts precisely & fluently using words.
- Memorization ability - The talent for quickly & accurately recalling or memorizing information.
- Spatial ability - The capacity to visualize & manipulate objects or concepts within a mental space.
- Perceptual ability - The skill of perceiving objects or situations accurately, such as making accurate judgments about people or things.
- Reasoning ability - The ability to apply logic.
- Deductive reasoning - Moving from a general rule to specific instances.
- Inductive reasoning - Moving from specific observations or experiences to form a general rule.

Thurstone also introduces a problem solving

factor, suggesting that most tasks require a combination of several of these primary abilities rather than just one.

• Evolution & refinement of Thurstone's theory

- Revising original assumptions - Although Thurstone initially argued that the 7 primary mental abilities were independent & lacked a common factor, his subsequent experimental findings revealed a positive correlation between these abilities. This proved that they were somewhat interdependent.

- The 'Second-order' General factor - Thurstone acknowledged the existence of a second-order general factor. This effectively admitted that while his specific primary abilities exist, there is an overarching influence that connects them, correcting his previous stance of non-existent 'general factor'.

• Practical applications

- Profiling & assessment - The theory allows for the creation of a percentage rank & mental ability profile for an individual. By using specific tools like the Chicago test, educators or psychologists can map out a subject's unique strengths & weaknesses across the 7 primary mental abilities.
- Diagnostic potential - Because this framework can identify specific areas of cognitive struggle, it serves a diagnostic function. This enables professionals to provide

practical guidance tailored to the individual, helping them overcome specific intellectual hurdles & improve performance in their weaker areas.

• Limitations of the theory

- Misleading terminology - The term 'primary mental abilities' is misleading because the identified abilities are not truly 'basic' or 'foundational', they are somewhat advanced in nature.
- Limited scope - This theory overlooks other forms of intelligence such as social, aesthetic, musical & mechanical capabilities, which are not covered by the 7 categories he proposed.
- Challenging the 'absolute' nature - Thurstone originally claimed these abilities were 'absolute'. However this was later proved incorrect by researchers like J.P. Guilford who categorized these into 3 dimensions & Philip Vernon who proposed a hierarchical model.

2. GUILFORD'S STRUCTURE OF INTELLECT(SOI) MODEL

- Background & development - The model was developed by J.P. Guilford & his associates at the Psychological Laboratory of the University of Southern California. It was created through extensive factor-analytical research studies, which involved conducting numerous intelligence tests on participants.
- Core concepts - J.P. Guilford determined that any

mental process or intellectual activity can be categorized into 3 basic dimensions. These dimensions function as parameters to describe human intelligence.

- Operations - This dimension refers to what the respondent actually does when performing a mental task ex:- cognition, memory or evaluation.
- Content - This dimension describes the nature of the material or information being processed during the intellectual activity.
- Product - This refers to the final form or result derived from processing the information ex:- units, classes or systems.

Any mental act is a combination of these 3 factors working in tandem.

• The Six operations -

1. Cognition - Understanding or discovering information.
2. Memory recording - Storing information.
3. Memory retention - Keeping the information in memory.
4. Divergent production - Generating multiple creative or unique solutions.
5. Convergent production - Generating the single best or correct solution.
6. Evaluation - Assessing whether the information or solution is accurate or appropriate.

These operations are part of a larger, logical flow of how our minds process information.

• The five content categories-

1. Visual - Information perceived through sight.
2. Auditory - Information perceived through sound.
3. Symbolic - Information consisting of letters, numbers or signs.
4. Semantic - Information involving the meaning of words & language structures.
5. Behavioral - Information related to human behavior, attitudes, needs & intentions.

• The six product categories-

1. Units - Individual pieces of information.
2. Classes - Sets of items grouped by shared properties.
3. Relations - Connections or associations between diff items.
4. Systems - Organized structures or groups of interrelated parts.
5. Transformations - Changes, modifications or redefinitions of existing information.
6. Implications - Future consequences, predictions, or practical applications of the information.

Because any mental activity involves all 3 dimensions Operations, content & Products - the theory is referred to as 3D model.

• Evolution of the SOI model-

- Evolution of components - Guilford modified the SOI model 3 times throughout his research. Initially the model proposed 120 components (based on $4 \times 5 \times 6$ structure). It

was later updated to 150 components ($5 \times 5 \times 6$) & finally to the current 180 components ($6 \times 5 \times 6$).

- The mathematical calculation - The total no. of intellectual abilities or "cells" in the model is calculated by multiplying the dimensions: 6 operations $\times$ 5 contents $\times$ 6 products = 180 total cells. The jump from 150 to 180 occurred when Guilford separated the "Memory" operation into 2 distinct categories: Memory recording & Memory retention.
- Visualizing the SOI - The model is described as a 3D box or cube. Each "cell" within the cube represents at least one distinct intellectual factor or ability. Any single mental activity involves an interaction between these 3 dimensions, meaning no operation happens in isolation from content or product.
- Educational implications of SOI model
- Understanding specific abilities - By breaking down intelligence into various operations, contents & products, the model allows educators to analyze a student's specific cognitive strengths & weaknesses. This leads to more precise educational guidance.
- Addressing learning progress - If a student has adequate intelligence but shows unsatisfactory progress, this model helps diagnose the root cause of the failure. Educators can then modify their curriculum & teaching methodologies based on these findings.

- **Targeted intellectual development** - The model emphasizes the need to focus on specific intellectual abilities to help them develop. This is particularly relevant for enrichment programs designed for gifted students, who might otherwise be left behind by standard classroom pacing and need extra challenge to stay engaged. Conversely for slow learners or those struggling, the model supports remedial teaching which involves diagnosing specific cognitive weaknesses & tailoring instruction to address the gaps.
- **Focus of attention** - Educators are encouraged to identify & target specific skills for development. By understanding the different components of intelligence teachers can intentionally design their instruction to strengthen the particular mental abilities a student needs to improve.

✓ Practical applications for school systems

- **Student learning mechanism** - Students do not just provide simple responses; instead their cognitive processes resemble a computer. They acquire information, store it in memory & retrieve it for use when needed.
- **Innovative classroom practices** - This perspective encourages educators to implement new teaching strategies & practices in schools that align with this model of information processing.

- Foundation for future learning - By focusing on specific intellectual abilities, schools can create a stronger foundation for students, ultimately leading to more effective learning outcomes in the future.
- Collective teaching - When students possess adequate intelligence but still face learning difficulties or failures, the model advocates for a diagnostic approach. This requires an accurate assessment of the student's specific abilities, followed by concrete steps to identify & address their unique strengths & weaknesses to facilitate improvement.

3. VERNON'S HIERARCHIAL THEORY

- Purpose - Vernon's theory is significant because it serves as a bridge between two contrasting viewpoints of Spearman & Thurstone. Vernon aimed to reconcile these perspectives by proposing a hierarchical structure that incorporates both general & specific abilities effectively filling the gap between these two models.

• Structure of the hierarchical theory

At the top of Vernon's model sits the General Intelligence (g) factor. This represents the highest level of intelligence & acts as the most significant source of variance in an individual's cognitive abilities.

Vernon breaks down this (g) factor into 2 major group factors at the second level of his hierarchy

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- Verbal-educational (v:ed) - This group factor encompasses verbal, numerical & educational abilities.
 - Practical-mechanical (k:m) - This group factor focuses on practical, mechanical, spatial & physical abilities.
 - Integration of groups & specific factors - Beyond the primary division into v:ed & k:m group factors, Vernon further divides it into
 - Minor group factors - The two major factors can be broken down into smaller, more specific group factors to better categorize distinct skill sets.
 - Specific factors (s) - At the base of the hierarchy, the model reaches the level of specific factors. These represent the highly specialized abilities that contribute to an individual's performance on very narrow, specific tasks.

By organizing intelligence this way, Vernon effectively creates a system that honors all levels of cognitive analysis: the general intelligence (g) that impacts overall performance, the group factors that cluster related abilities & the specific factors (s) that define unique skill niches.

- Influence of heredity & environment on intelligence
Starting in 1969, Vernon began investigating how genetic factors & the environment impact intellectual growth. He emphasized that both heredity & environment

play a critical role & they work together. Vernon concluded that individual differences in intelligence are approximately 60% attributable to genetic factors, while remaining 40% attributed to environment. He also suggested that genes may play a role in the average mental ability differences seen across different groups.